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FOREST PRODUCTS LABORATORY † FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

SPECIAL METHODS OF SEASONING WOOD

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CHEMICAL SEASONING

Chemical seasoning consists of treating green wood with a hygroscopic chemical and air drying or kiln drying the treated material. The present process involves comparatively short treating periods. The chemical is used to reduce or prevent surface checking during seasoning, rather than to accomplish actual drying or speed the drying.

The process was not fully understood until the U. S. Forest Products Laboratory began an investigation in 1930. In 1938, the Laboratory and the West Coast Lumbermen's Association developed a process using urea to reduce checking in Douglas-fir timbers. This treatment was widely used in the seasoning of high-grade, Douglas-fir timbers, particularly flat-grained clears and ponton stock during World War II.

Since 1947, very little use has been made of the chemical seasoning process for Douglas-fir. Increasing use has been made recently, however, of a proprietary sodium chloride preseasoning treatment for hardwoods in the South and East. Chemical treatment adds to expense, and the presence of the chemical in the wood may be a disadvantage. The process, therefore, is economically practical only when the increased value of the chemically seasoned lumber offsets the added expense.

The objective of the preseasoning treatment is to impregnate the outer zone of lumber with chemicals to a depth of about one-tenth of the thickness, with the highest concentration at or near the surface. The chemicals maintain the outer zone at a higher moisture content during drying than occurs with untreated wood. The hygroscopic nature of the chemical tends to keep the wood moist. This reduces the shrinkage of the outer zone and lessens its tendency to surface check. Some chemicals impart a permanent antishrink effect which is separate from the actual moisture effect.

The presence of the chemicals in the outer zone does not interfere with drying. Moisture from the untreated interior passes through the impregnated outer zone and evaporates. For some species, such as Douglas-fir, chemical seasoning cuts drying time by permitting the use of faster kiln-drying schedules. In most cases, however, treatment reduces surface checking without decreasing drying time. Kiln schedules must be modified somewhat to bring the initial relative humidity below the relative humidity in equilibrium with the saturated chemical solution.

Rept. No. 1665-6 (Revised)

† Maintained at Madison 5, Wisconsin in cooperation with the University of Wisconsin

Numerous chemicals have been tried. Common salt is cheap and effective in reducing surface checking, but it corrodes metals and may damage dry-kiln equipment, woodworking machinery, and hardware fastened to the treated wood. Urea may not always be as effective in reducing surface checking in other species as it is in Douglas-fir. Under some conditions, urea-treated oak may check worse than untreated oak. Urea corrodes copper-bearing metals and discolors wood. Other chemicals investigated include invert sugar, molasses and other low-grade sugars, diethylene glycol, and a urea-formaldehyde mixture.

The proprietary sodium chloride mixture, which consists principally of common salt, has corrosion inhibitors in it. This material, which can be called a buffered sodium chloride, appears as effective as pure salt in controlling seasoning checks. Recommendations of the manufacturer call for applying the chemical to green wood only, then air drying the wood enough so that final kiln drying can be carried out with a relative humidity sufficiently low that moisture does not condense on the wood. When the wood is kiln dried immediately after treatment, the inhibitors are not effective enough to prevent corrosion of the kiln equipment.

The most efficient treating method, so far as reducing surface checking is concerned, is the soaking method. However, this requires a large investment in chemicals, tanks, and other equipment, and the solution becomes discolored with use and discolors the wood. Dry spreading, the cheapest method of application, has been used quite extensively in the recent application of buffered sodium chloride on hardwoods. It also was used in the wartime treatment of Douglas-fir. The lumber and chemical are piled in alternate layers, using from 35 to 140 pounds of chemical per 1,000 board-feet. When the chemical has been absorbed, the lumber is piled for seasoning.

Chemical seasoning agents can reduce the strength of wood and sometimes cause problems in gluing and finishing or corrosion during use. Although large quantities of wood treated with such chemicals have been used successfully for a variety of purposes, some consideration should be given to these disadvantages.

Tests have shown that red oak treated with either sodium chloride or buffered sodium chloride, partially air dried, and then kiln dried with a final temperature of 165° F. can suffer a reduction in toughness of about 30 percent. The corresponding reduction in bending strength would be 10 to 15 percent. One test on maple showed a smaller reduction--only 10 percent in toughness, equivalent to 3 to 5 percent in bending strength. When oak treated with sodium chloride was air dried to

20 percent moisture content, then kiln dried with temperatures not exceeding 130° F., no significant reduction in toughness occurred. Commercial driers of sodium chloride-treated oak have used final kiln temperatures up to 150° F.

In limited tests on the gluing of salt-treated red oak with liquid animal glue, hot animal glue, and polyvinyl resin-emulsion glue, the hot animal glue and polyvinyl glue were not affected by the treatment. For the liquid animal glue, joints made with salt-treated wood were very significantly lower in dry strength than those made with normally seasoned wood. No reports have come to the attention of the Laboratory on the salt-treated wood being difficult to glue other than with liquid animal glue. Salt treatment, however, is reported to prohibit at least some applications of electronic gluing because of arcing.

The finishing characteristics of salt-seasoned wood have not been studied. Presumably a considerable amount of wood so seasoned has been used for furniture and other items without difficulty in finishing. Although the surface layers that contain the greatest concentration of salt are removed in the machining operation, some salt remains in the surfaced wood and could interfere with finishes if used under conditions involving extremely high relative humidity. Under such conditions, the salt could attract enough water to the wood to disrupt the finish. Poor results during manufacture were obtained with one finishing system, however, by a firm that makes a practice of carefully controlling the moisture content of the wood going into its furniture production.

When the proprietary sodium chloride mixture was introduced several years ago, it was hoped that the corrosion-inhibiting chemicals would be effective during use. This has not proven to be the case. Under relative humidity conditions above 75 percent, metal in contact with the treated wood has corroded. Where it is known that the wood will be subjected to high humidities, salt treatment should be avoided. When it is used, care should be taken to avoid use of excessive amounts of chemical or prolonged treating time.

Because of modification of the electrical properties, the moisture content of salt-treated wood indicated by an electrical moisture meter will be considerably higher than the actual moisture content.

Obviously, it is pointless to use chemicals as an aid to seasoning items that, without treatment, can be satisfactorily air dried and rapidly kiln dried without surface checking. Generally, 4/4 and thinner oak and other hardwoods can be satisfactorily seasoned without predrying

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treatment, provided proper procedures are used. There are advantages in using chemical pretreatment for thicker material, however. Whether or not to use chemicals in seasoning items of lumber that check in drying will depend upon the economics of each situation.

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Madison 5, Wisconsin
April 1960